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MEMORANDUM FOR PRS (In-House Publication)

FROM: PROI (STINFO)

SUBJECT: Authorization for Release of Technical Information, Control Number: **AFRL-PR-ED-TP-2002-122**  
Capt Jeff Thornburg and Lt Daniel Wright (PRSE), "Integrated Powerhead Demonstration's Oxidizer  
Turbopump Cold Flow Tests Completed"

**No Forum/Audience Provided**

**(Statement A)**

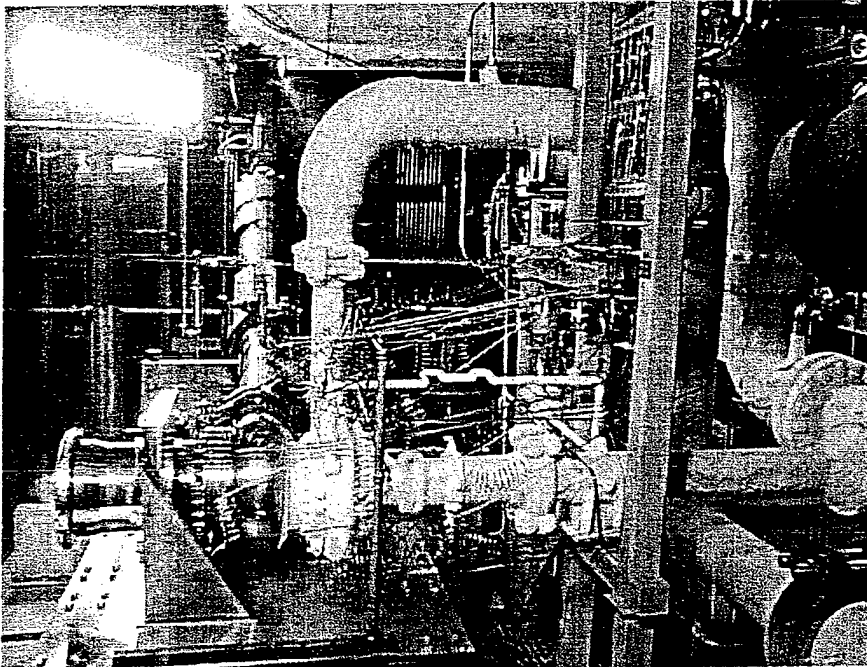
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20 May 2002

## **Integrated Powerhead Demonstration's Oxidizer Turbopump Cold Flow Tests Completed**



The Integrated Powerhead Demonstration program's oxidizer turbopump during a cold flow test in Nov 2001.

### **Payoff**

The Integrated Powerhead Demonstration (IPD) program successfully completed a series of cold flow tests on its oxidizer turbopump. This technology development turbopump demonstrated a number of innovative technologies: 1) A rotor fully supported by hydrostatic bearings and a balance piston. 2) A blisk and turbine components designed to be compatible with a high-temperature oxygen-rich environment. 3) A back-up clutching bearing. 4) A lift-off seal to separate the cryogenic and hot-gas regions of the pump.

### **Accomplishment**

The Propulsion Directorate completed this series of 11 tests on the oxidizer turbopump in November of 2001. Driven with gaseous nitrogen which pumps liquid nitrogen, the pump met all target test objectives. The tests conducted at NASA Stennis Space Center, Mississippi were completely successful. Hot gaseous oxygen will drive the turbopump in the next test series, with liquid oxygen being pumped. A standard oxygen-rich pre-burner is currently being characterized for use in this follow-on hot-gas testing. An IPD oxygen-rich pre-burner is under development for future tests.

### **Background**

The IPD program is an integral part of the Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program. The IPD turbomachinery effort has two main technical

goals: (1) to increase turbine life by using a full flow cycle staged combustion design and (2) to increase bearing lifetime and reduce wear by incorporating hydrostatic bearing technology in both the oxygen and hydrogen turbopumps.

This IHP RPT program demonstration is one of many in a series that are part of a three phase, government and industry coordinated effort that began in 1993. The overall program vision is to double the nation's propulsion capability by 2010. The Program is endorsed by both government and industry with representatives from industry, NASA, Air Force, Army, Navy, and the Office of the Secretary of Defense. To show achievement of goals, there is a demonstration at the end of each of the three distinct phases.